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RESEARCH ARTICLE

Non-technical approach to the challenges of ecological architecture: Learning from Van der Laan

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Abstract
Up to now, ecology has a strong influence on the development of technical and instrumental aspects of architecture, such as renewable and efficient of resources and energy, CO_2 emissions, air quality, water reuse, some social and economical aspects. These concepts define the physical keys and codes of the current 'sustainable' architecture, normally instrumental but rarely and insufficiently theorised. But is not there another way of bringing us to nature? We need a theoretical referent. This is where we place the Van der Laan's thoughts: he considers that art completes nature and he builds his theoretical discourse on it, trying to better understand many aspects of architecture. From a conceptual point of view, we find in his works sense of timelessness, universality, special attention on the 'locus' and a strict sense of proportions and use of materials according to nature. Could these concepts complement our current sustainable architecture? How did Laan apply the current codes of ecology in his architecture? His work may help us to get a theoretical interpretation of nature and not only physical. This paper develops this idea through the comparison of thoughts and works of Laan with the current technical approach to 'sustainable' architecture.

1. Introduction

Ecology has not just demonstrated environmental problems, climate change, and alarming events in biological processes that affect living beings. It has also confirmed the need for a different relationship between human beings and their world—with the environment in which they live, and above all, with other humans and nature.

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In the past, several thinkers, including Thoreau, Huxley, and Whitman, focused on this aspect of ecology. Other thinkers, such as Gandhi and Tolstoy, devoted themselves to a philosophy of non-violence and movements and philosophies declared as ethical-ecological. This viewpoint is expressed by Naess (2006) in the Deep Ecology movement, which is the "ecosophy" defined by Guattari (1990) and argued by Serres (2004). All of these movements advocate a necessary change in our current point of view: from the generalized anthropocentrism of our developed world to non-anthropocentrism. We must delve deeper into this transformation and redefine where the "natural" limits are; this is the new paradigm. This paradigm appears to be a confrontation between two points of view; one considers the planet a materialistic instrument only, and the other is steeped in the vision of man belonging to nature.

A paradigm to this extent requires a critical reflection in architecture. We need a new interpretation of architecture. If architecture is conceived as the natural space where man lives, what is the architecture of the new relationship of mankind with nature? What could be an authentically ecological architecture? How might a new non-anthropocentric point of view affect architecture?

2. Architecture and nature in the current context of ecology

A relationship has always existed between nature and architecture. The human body as a natural reference has been present in the harmony of columns, classic orders, and buildings. Several authors, such as Filarete, interpreted the birth of architecture as the protection of man against nature's adversities, even iconographically.[1] Other relationships with nature have been of adoration and observation. Stonehenge was a solar calendar temple to observe and worship nature. Landscape gardens and the Baroque were attempts to dominate nature and introduce it into architecture. For other architects, nature is the source of admiration, imitation (Ruskin), and inspiration. For the Enlightenment architects, such as Ledoux and Labrouste, nature is reinterpreted in light of the scientific knowledge of an era. The relationship between nature and the modern movement continues to be examined. According to Alejandro de la Sota, the relationship between architecture and nature is that of a student and a teacher.

> *"Architecture, abstract art, is, may be, natural: studying Nature is good for architects… Nature teaches us, shows us architecture and forms, materials and even how to treat them."* (De la Sota, 1956)

All of these relationships (imitation, admiration, and interpretation) come from outside nature, as if architecture were external to it. The assumption is that the relationship between nature and architecture is the interaction between different elements that are foreign to each other. At best, it has been a relationship of tolerance, in which the other is accepted as different and not as the other part of a whole. The assumption is that architecture interacts with nature, but it "is not" nature. In addition, based on the recent ecology paradigm, nature (the natural environment) is an element damaged by our activity and our way of inhabiting the planet. Thus, what must the correct relationship between nature and architecture be?

To address environmental problems, "ecological" or "green" architecture[2] emerged and is developing through diverse "eco-logics" (Guy and Farmer, 2001). This green concern has many technical, health, and social aspects to deal with, as well an ethical context (Woolley, 2000). An architecture has been designed according to this paradigm. This architecture has fundamentally practical characteristics and is based on scientific, economic, and social parameters. Even now, this architecture strongly influences the development of technical and instrumental aspects. We know how construction activities affect the Earth's crust and the atmosphere. We also know that these activities are often detrimental to biodiversity. We have analyzed the effect of energy consumption on the environment, the use of renewable energy, the consumption of water and other natural resources, the management of waste, the embodied energy of construction materials, and so on. All of these efforts are technical applications of the paradigm and the practical application of mathematics and the laws of physics and chemistry.

These approaches are a practical means of bringing us to nature, and these are applied knowledge. However, is there another way of bringing us to nature? Where is sensible, theoretical, artistic, intellectual, creative, imaginative, and abstract knowledge? The current green approach *"is lacking because it doesn't give us meaning, and it is lacking because it doesn't really help us regain a relationship with nature"* (Dawson, 2016a). Two scenarios exist: one only considers the physical and material world, whereas the other is steeped in a vision of man with a psyche, a soul, a nature. A truly ecological architecture must be highly comprehensive if it is to express our actual relationship with nature. Ecology has shown us that our relationship with nature is not only a materialistic challenge. We need a critical revision that includes changes in ethical values and aspects in our lifestyles.

> *"It's not about sustaining physical nature: it's about building a world that answers to our own perception and our own psychology. And then, if we become more at home in our own skin, we'll treat physical nature with more respect."* (Dawson, 2016a)

Therefore, our architecture cannot continue to be erected with the same criteria as when we ignored it. We must know how to build the space for human beings that surpasses temporal circumstances and carry it out in harmony with the environment. Technical issues are not sufficient. Architecture

[1] Adam, terrified, covers his head with two hands when he is expelled from Paradise: that is the origin of the primitive cabin form, according to Averlino Filarete. Arnau, J. 1998. *La teoría de Arquitectura en los tratados*. Ed. Tebas Flores. Madrid

[2] Because 'green' and 'sustainable' are extremely wide ranging and there are not a consensus and official definitions, we will use this terms as Guy and Farmer do in *Reinterpreting Sustainable Architecture: The Place of* Technology: those design which approaches are identified as a significant barrier to solving what are considered to be problems such as global warming and other environmental impacts. Guy and Farmer interpret six ecological approaches: eco-technical, eco-centric, eco-esthetic, eco-cultural, eco-medical and eco-social.

needs its own theoretical body to obtain a coherent definition. The current development of environmental knowledge must be completed with the laws that guide the perception of human beings in their own world and that are part of their intellectual capacity.

3. Discoveries of Van der Laan

The buildings designed by Dom Hans Van der Laan may help us experience our relationship with nature. The Benedictine monk and architect Van der Laan (Leiden 1904–Mamelis 1991) wrote several books explaining his theories about architecture and put his ideas into practice by designing several buildings[3] that were built between 1960 and 1995. He designed and created structures in other fields, such as typography, vestments, furniture, and liturgical objects. In 1960, Van der Laan published his first book on the theory of architecture as *Le Nombre Plastique* (The Plastic Number). After that, he explained his thoughts by publishing works in different languages, including *Het vormenspel der liturgie* (Van der Laan, 1985), *L´Espace Architectonique (1989)* and *The Play of Forms* (2005), until his death in 1991.

The first approach to the space of the buildings designed by Van der Laan is sensitive, sensorial, and spiritual. We find a particular architecture that produces a sense of beauty, calm, and harmony with an expression of extreme naturalness, radicalness, and delicateness at the same time; nothing is taken for granted, and time appears to disappear. This is a subjective appreciation. Could this particular feeling rest on an objective perception as well? Could we study Van der Laan's way of building through the prism of ecological architecture? Can we discuss how the usual green criteria in his works be applied? Could a direct relationship exist between eco-architecture and Van der Laan's architecture? If so, we may effectively augment the relationship between green architecture and human sensibility.

3.1. Nature according to Van der Laan

The word "ecology" was not a part of the vocabulary of Van der Laan. No specific concern for ecology was reflected in his writings. However, he expressed some dissatisfaction as follows:

> *"Perhaps the decline of architecture and of the whole man-made environment during the last century of two..."* (Van der Laan, 2001a)

In an attempt to combine two worlds, Van der Laan stated in 1968 that:

> *"... We also see a sort of impoverishment in architecture, a unilateral functionalism that reduces the house to something material alone. In Den Bosch,[4] however, we have grafted a superior world - the world of the spirit - onto functionalism, transforming the functional group into an expressive group, something that appeals to the spirit. That's why we have always tried to combine two worlds in architecture: one material, technical and utilitarian, and the other using this materialist complex as a new material that we create in a more understandable whole with a type of super-technique, which is what we have called this disposition."* (Van der Laan 1968, cited by Beekhof, 2010)

In the first chapter of *L'Espace Architectonique*, Van der Laan (1989) focused on the relationship between man and nature. According to Van der Laan, architecture completes nature. Architecture is a reconciling agent that facilitates man's subsistence. Van der Laan does not see art as an imitation of nature or a continuation of its process, but as a reaction to the conflict between the natural world and humans.

> *"As material beings we are drawn from the earth and absorbed into the natural order..."* (Van der Laan, 2005)

According to Padovan (1994), Laugier (also a Dominican monk) and Van der Laan began to consider shelter as the immediate purpose of architecture. However, both abandoned this view to concentrate on a more essential and universal role that serves not just the body, but the complete human being. For Van der Laan, architecture's purpose is to organize the space provided by nature via the imposition of limits in space, shapes, and sizes. Accordingly, Van der Laan developed all the concepts that make up constructed space (forms, magnitudes, geometry, functions, and measurement systems).

> *"One has only to consider how architecture, which arises from our need of habitation, has the power to give measure to the measureless space of nature, which thus becomes knowable for us; or how in song and dance the continuous passage of time takes on discrete form, and is thus made countable."* (Van der Laan, 2005)

In other words, to make sense of our existence in relation to the natural environment (in nature), Van der Laan would have us create intermediary forms designed to bring about harmony between our body and nature. For Van der Laan, expressive forms respond to the intellect, which in turn allows man to move up from one form-world to the next. Remery (2001) informed us how the theory of Van der Laan on the intellect by the senses are related to important Thomistic themes, which is one of his intellectual references.

Van der Laan attempted to apply parameters to natural laws from an intellectual point of view via sense perception. His goal was not to build a type of nature but to help us become aware of the world—the interior world—we build that is necessarily set off from nature. In doing so, we build an interior in contrast to the limitless exterior of nature. At the same time, we become aware of our own interior as analogous to the interior we have built. Van der Laan wished

[3] Main works: Crypt, Church and Library of Abbey St-Benedictusberg Monastery (1956–1985) in Lemiers (The Netherlands); Monastery Abbey Roosenberg (1972–1975) and Monastery Mary sister of St-Francis (1978-1985) in Waasmunster (Belgium); Huis Naalden residence, (1978–1982) in Best (The Netherlands) and Benedictine Monastery Church (1986–1995) in Tomelilla (Sweden).

[4] The Bossche School (Den Bosch) was an architectural traditionalist movement in The Netherlands from 1940 to 1970. Important for the Bossche School was a three years course church architecture in the city Den Bosch in the period 1946 till 1973. (http://news.architectuur.org/movements.php#bossche), (accesed 24.01.16).

to humanize nature by making us aware of the place we inhabit by building because it may *"help to better understand many aspects of architecture"* (Beekhof, 2010).

3.2. Role of construction materials in creating a timeless and enduring expression

According to Van der Laan, the housing process has four elements: nature, materials, home, and man. These elements are interrelated. Materials are obtained from nature, houses are built with materials, and man lives houses. To live in a house, to realize it technically (build it), and to prepare the materials are the three functions that connect the four elements. Van der Laan's texts did not show references to planning, material resistance, or construction techniques. However, the abundance of technical documentation on the Sint Benedictusberg Abbey indicates the careful detail in which it was built. In Van der Laan's work, the technique is not concealed nor blatantly displayed; it is simply present. The construction materials are presented almost in their original form. The construction techniques are not masked, the lighting is clearly visible, and the heating system is simply present. The technique is secondary to the main principle.

The materials utilized by Van der Laan are very straightforward: load bearing brick for the exterior and interior walls, concrete floors, and stairs; wooden roofs on churches; wooden doors and frames; barrel tiles as capping stones; and simple locks. Voet (2012) described these as a minimalistic formal language dominated by simple material finishing (wood, paint, or roughcast with plaster in complementary gray colors), thereby making the space extremely tangible. The amount of materials is minimized, slightly transformed, not highly sophisticated, and barely coated. This architecture is fundamentally massive.

The selection and use of materials coincide with some of the works of other architects, such as Van Eyck and Utzon (Figures 1 and 2). A startling similarity in expressive and decisive simplicity, emphatic volumes, and the use of materials can be observed in some of the works of these architects. A similarity in functional distribution also exists, such as the case of Utzon's Kingo houses (also called Romerhusene houses) and Van der Laan's Creyghton and Naalden houses in Best (Figure 2). Van der Laan collaborated with Van Eyck in designing the de Pastor van Ars church. In this church, Van Eyck almost exclusively employed concrete as the construction material: reinforced and exposed concrete in beam structures, main beams, and the rings of skylights; blocks of concrete for enclosures and walls on the exterior and interior; and concrete in floors, stairs, and shutters. Finally, Van Eyck used wood for doors and metal in places where using another material is difficult (Figure 1). These cited examples and Van der Laan's buildings limit themselves to four or five construction materials.

Currently, conventional construction utilizes many highly complex, transformed, and specialized materials for specific functions. The commercial selection is vast and often confusing. Meanwhile, composition, trajectory, and

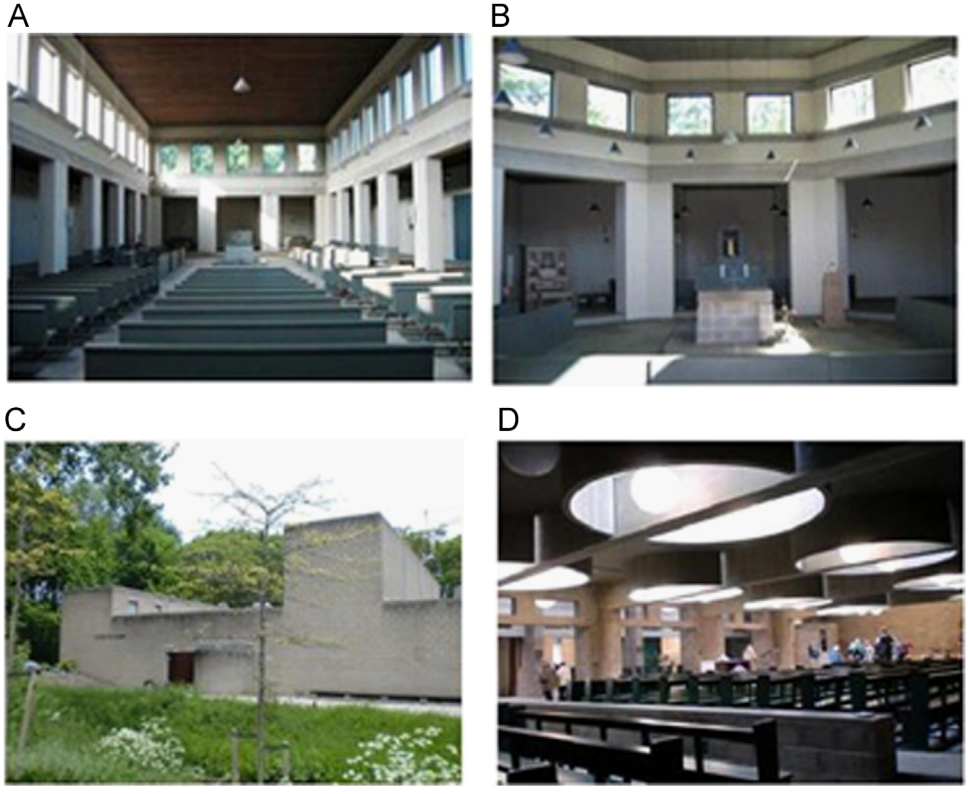

Figure 1 (A) Van der Laan, D.H. Sint Benedictusberg and (B) Van der Laan, D.H Roosenberg. (C,D) Van Eyck, A. 1969. Pastoor van Ars Church The Hague.

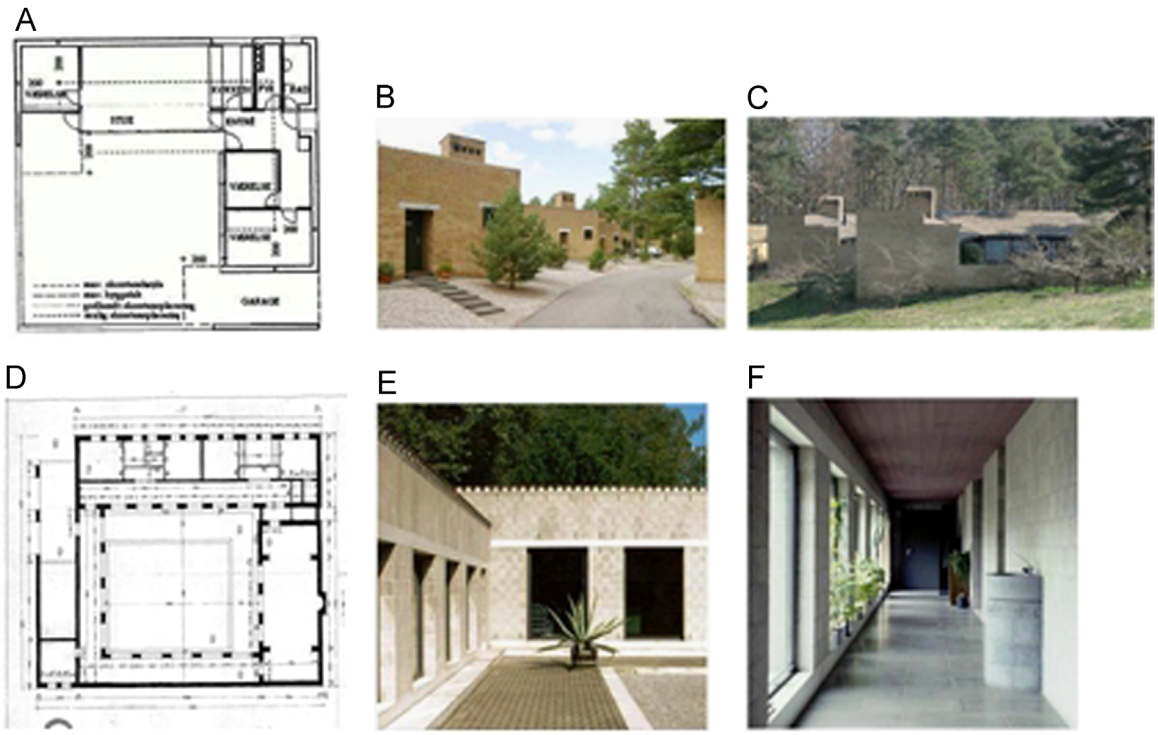

Figure 2 (A,B,C) Utzon, J. 1958. Kingo Houses, Helsingor, Danmark. (D,E,F) Van der Laan, D.H. 1978–1982. Huisnaalden Best. The Netherlands.

environmental impact analyzes of construction materials significantly affect green or ecological architecture. This is an important consideration in both green high-tech and green low-tech architecture. All materials, elements, or systems are evaluated according to their complete life cycle analyzes (LCA). These methods study the embodied energy and the environmental effects of all the processes related to the construction material: from extracting the raw materials to the building's final use, including transformation, manufacturing, maintenance, transporting, and the hypothetical final recycling or dismantling.

Several types of green architecture (for example, earth construction) use pre-industrial vernacular materials. However, conventional green construction tends to use sophisticated technology. The discourse on high-tech green construction virtually disregards the need for an exhaustive treatment of basic materials, such as those in Van Eyck's church and Utzon and Van der Laan's buildings. These architects made a very specific and clear choice: to use a limited number of straightforward construction materials for numerous functions. Current widespread construction methods are exactly the opposite; they use a wide variety of sophisticated materials for very specific functions, supported by a complex LCA. After applying complex, contemporary environmental evaluation tools to both options, the result would probably be in favor of the choices made by Van der Laan, Utzon, and Van Eyck. Selecting materials in or near their original form is an appropriate option from the ecological point of view. From an expressive point of view, Voet stated his view toward Van der Laan`s buildings as follows: *"the use of simple material finishing enhances the sensorial qualities of the materials, rendering the space extremely tangible. The focus moves from the building material to matter. This is enhances by the light"* (Voet, 2012).

3.3. Everything is measured, even nature

By observing nature, Van der Laan concluded that several formation laws that relate our perception of the three dimensions of space to one another exist. Thus, Van der Laan embraced Plastic Number theory based on the development of mathematical ratios among 3D spaces obtained from observing nature. The Plastic Number may also be called the "plastic ratio" because it does not actually refer to a specific figure or quantity, but to a ratio. In the words of the Van der Laan Foundation,

> *"Based both on experiments and mathematical logic Van der Laan arrived at a ratio he called the plastic number. This ratio of four to three provides the increment of change we need in order to relate units of different sizes. Imagine a set of cylindrical building blocks: the blocks grow in length in relation to their smaller neighbour by the ratio of four to three. This set of blocks was the first abacus that Van der Laan made."* (http://www.vanderlaanstichting.nl/en/theplasticnumber/introduction, revised 21/01/2016)

This subject in geometry elicited the interest of philosophers, scientists, crystallographers, and naturalists (Plato, Pythagoras, Kepler, and Huygens) and has become an essential

part of the idea of architecture (Vitruvius, Averlino Filarete, Alberti, Serlio, Luca Pacioli's "divine" proportion, the Golden Ratio, and the Fibonnaci sequence). This subject is framed in the midpoint of all these disciplines (philosophy, science, and art) (Padovan, 2001) because its meaning surpasses that of mere geometry. Symmetry, for example, is regarded in the study of proportions and spatial relations as a balancing element that is associated to beauty and elegance but also from a philosophical and psychological perspective because the dichotomy between right and left has a double meaning in our culture (Rees 2001).

The Plastic Number creates an endless sequence of ratios (proportions) comparable to the Fibonacci series. However, Voet (2012) and Seung Yeon (2004) emphasized that Van der Laan's ratio differs significantly from that of his contemporaries, such as le Corbusier and his Modulor, based on Ghyka's analysis of the Golden Section because of the limitations of the Modulor and its abstract nature. For Van der Laan, the focus is not mathematics itself, but its ability to interrelate concrete spatial phenomena through the ratio of proportions. Van der Laan does not start from fixed measures; he *"sees the Plastic Number as a bridge between experience and abstraction, between geometry and mathematics"* (Voet, 2012).

The Plastic Number is not merely an application of mathematics; it is the relation perceived within experience. The Plastic Number is an attempt to derive laws on how human beings perceive the spaces they dwell in. In the ecological scenario, our current, rationalized, empirical, positivist, and practical knowledge causes us to look for the parameters that measure the changes in our planet. We apply calculations and systematic dynamic methods to describe our effect on physical nature. Both Van der Laan, with his theory on the one hand, and the paradigm of ecology on the other hand use the laws of mathematics to understand the natural world but applied the principle to different sectors of human nature. Van der Laan applied mathematics to the spirit; the ecological sciences apply it to the physical world alone. Both are concerned with human health and human relationship to nature.

Van der Laan studied proportions to establish harmony with the natural environment. He applied the Plastic Number as a leitmotif to all orders and scales: in the generation of spaces in churches or homes, in the structure of cities, creation of objects, furniture, clothes (Van der Laan, 2001b), and typography. Van der Laan applied the Plastic Number to all human scales because the theory is the basis of human perception.

New environmental sciences measure the effects of our actions on physical nature. They determine the limits of the bio-capacity of the Earth. In this context, they measure at the full range of scales. Environmental sciences study the effects and ecological footprint of a country, a city, an element, or a product, including a living style. The methods of environmental evaluation for buildings, which were developed in the 1990s (GBTool, LEED, BREEAM, VERDE, Ecómetro, etc.) (García-Navarro, 2013), analyze and apply parameters that adopt *"environmental, economic, and social"* criteria. Their objective includes the measurement of comfort, air quality, energy, outdoor views, affordability, universal accessibility, and so on. This objective, in general, is a multi-disciplinary approach to human activity. Every aspect is measured. Nevertheless, these methods hardly cover the full richness of human beings. Could these two approaches (Van der Laan's and new environmental sciences) be complementary?

3.4. Importance of physical limits of space in demarcating the human habitat

In his text, Van der Laan stated: *"If we experience space in only one way, a single insulating separation between the absolute interior and exterior would suffice"* (Van der Laan, 1989). If we experience space in various ways, various delimitations are required because architectonic space is necessarily multiple. Man experiences nature's magnitude through a portion of natural space limited by walls. The space that man needs to inhabit is a "reserve" of outdoor space enriched by architecture. The experience in and out of these spaces vary. Referring to Van der Laan, Voet stated that *"it is the task of the architect to define an order in nature so that it can be read and understood: to create an inside in an outside as the primordial condition for living"* (Voet, 2012). Heidegger expressed the experience of inside and outside spaces in a similar manner in "Building Dwelling Thinking" (Heidegger, 1954). The dwelling process is a permanent exchange between "inside" (the life given to the interior of our walls and the life that completes our present experience) and the "outside" (the life that surrounds this space of our experience and represents natural space).

In Van der Laan's architectonic space, the "wall" is the concrete and massive element that delimits space, enabling us to experience the difference between inside and outside through our senses. The interior atmosphere of the inhabited space is literally the same atmosphere as the space surrounding it. However, in our experience, the two spaces are rather different. A wall in this sense is not a defensive wall, but a sieve that allows for an exchange between the physical conditions of spaces with similar characteristics. Pouderoyen (2001b) emphasized the influence of thinner or more massive walls in the conception of "inside–outside" spaces in current architecture.

In ecological or green architecture, the "skin" (the current way to refer to the wall in the eco-language) largely concentrates on innovation and study. It refers to elements or systems that determine the separation between inside and outside. The skin in "eco" architecture can be created in a highly technological manner or in a traditional manner with earth or raw materials. It can be horizontal, sloping, or vertical and preferably green on its surface. It can be sophisticated, thin or thick, flat or with many volumes, and static or dynamic. The skin can conserve or produce energy. The relevance of the skin is probably the principal concern of green construction because it is closely related with energy. Several green innovations are the antithesis of Van der Laan's idea of architecture as a reconciling agent in nature. An example is the Passivhaus standard, which is a model-building system to reduce energy consumption (Passivhaus, 2016). In this system, walls are elements that rigidly and drastically separate the exterior from the interior. This type of standard, which looks for the maximum insulation in a habitat space, is probably effective from an energy point of view but is far removed from our experience of nature. Architecture entails different conceptions; one is that architecture is a way to defend us from

hostile nature through strong insulation, and the other is that architecture is a way to help us adapt to nature. These two options may appear similar but are not.

In Van der Laan's work, specifically Sint Benedictusberg, we can spatially track the idea that architecture is a reconciling agent that facilitates man's subsistence and adaptation to nature. A chain of spaces exist between inside and outside and from the cell to the external surroundings: closed cloisters; semi-open, small patios; interior gardens; exterior gardens; a space for burials; and finally, the great space delimited by a double row of trees that surround the trapezoidal space. Various elements, whether they be tectonic, vegetable, or any other sort, may therefore delimit space to make it habitable. These architectonical elements gradually transition from internal to external spaces and facilitate our adaptation to different temperature and climatic conditions.

Padovan remarked that Van der Laan's general concept of the city and architecture has an undeniably classical and Mediterranean character (Padovan, 1994). In traditional Spanish architecture, La Alhambra has a large number of elements that delimit the inside from the outside. The complex of buildings that comprise La Alhambra is widely cited as an example of adaptation of climate through sensitive, creative, and rich experiences. Through its large and small patios, lawns, gardens, myrtles, ponds, fountains, porches, gates, light sieves, and double doors, it creates a multitude of different sequences that provide us the experience of moving from an interior setting to an exterior one. These strategies protect us from excessive sunlight and heat and transport us from a rather hostile exterior to a comfortable interior. Technically and ecologically, these elements, which are called "passive bioclimatic adaptation systems," are merely the climatic application of the concept of adaption to nature to gradual sensorial experiences. In La Alhambra, diverse and rich exchanges occur between the inside and outside. We can feel the atmosphere of nature through diverse experiences. This complex of buildings (La Alhambra) is extensively regarded as an ecological and bioclimatic example of architecture in the "green" repertoire.

Although expressive and formal language is nearly opposite in La Alhambra and Van der Laan (the first is rich in decoration, symbolisms, and religious and graphic expressions; the second is plastic, tangible, and without adornment), similarities still exist.[5] These similarities are principally the wealth of spaces and the concepts and multiple experiences from inside and outside as a leitmotif for the creation of architecture. In this final matter, which is the core in the current scenario of green architecture, both function as an important source of learning.

3.5. Timelessness as the time dimension

Ecologists (deep ecology) study man as a species in a timeless dimension. Van der Laan also thinks similarly. His writings lead to the generic and the universal; the particular and subjective barely appear in his texts. Time appears to be non-existent. Instead, Van der Laan is interested in the unchanging as a representative of the underlying substance.

> *"Because our artifacts must be brought into being by trial and error, they cannot all achieve an equal perfection. As individuals, we all leave traces in our work of the greater or lesser development of our skill. The more highly our skill is developed, the more universal the forms of our artifacts will appear, and the fewer traces will survive in them of the individual maker."* (Van der Laan, cited by Padovan, 1994)

Van der Laan does not seek peculiarity. He searches for what is common to all human beings. Human beings are not merely circumstantial beings; they belong to a species that has developed throughout centuries and maintains a common essence. Van der Laan concerns himself with what is common for centuries and even millennia. His interest is timeless.

It is not a mere coincidence that Van der Laan studied Stonehenge as an example and application of his principles. In so doing, he created a discourse that links us with building traditions millennia before Christ. For Van der Laan, Stonehenge represents the origin of architecture "*dans toute sa vigueur primitive*" (Van der Laan, 1989). He finds in Stonehenge all the architectural phenomena that gave rise to his discoveries (Van der Laan, 1989 p. 224). Definitely, "*cést par le moyen de la même demeure humaine queue nous rendons l´espace naturel intelligible aussi bien qu´habitable*." With this statement, Van der Laan concluded *L´Espace Architectonique* (Van der Laan, 1989).

The idea of timelessness is implicit in the work of Van der Laan. This concept emerges from the inherent reasoning of his theory, from the examples he cites, and from his own work. This same spirit of "primitivism" is manifested in all his buildings. Voet reported that Van der Laan developed a formal language inspired by Old Syrian churches and Italian medieval monastic architecture (Voet, 2012 p. 152). Van der Laan himself claimed that a specific ecclesiastical architecture does not exist. The essence of architecture for Van der Laan does not lie in its symbolism, typology, or functionality but in the tripartite way man experiences a building: the physical experience, sensory perception, and intellectual cognition of size. As Tiziana Proietti stated, the discoveries of Van der Laan lead us to question most contemporary designs. According to Proietti, "*building up spaces which are able to answer simultaneously to our mind, sensory observation and physical experience*" (Proietti, 2012).

Van der Laan does not commonly refer to other architects, except for Vitruvius. The very essence of timeless architecture is evident in several contemporary buildings. A few buildings exceed fashion, ephemeral circumstances, and superficial elements to place themselves in a language common to almost all times and cultures. Examples include the work of Gunnar Asplund (Figure 3) and several structures by Van Eyck (Figure 1) and Utzon (Figure 3). Buildings from a non-temporal community, such as the Shakers, which was derived from deep religious beliefs, show a pure, simple, timeless, and emphatic geometry (Round Stone Barn in Hancock, (Figure 3D) built in 1826). These buildings share Van der Laan's world view and use of measures, but none of them does so consciously, as far as we know. The buildings may only seem to resemble Van der Laan's buildings

[5] There are photographic documents that attest that the old Sint Benedictusberg abbey, built by Bohm, had a formal language neo-arabian on the ground floor, before being amended by Laan. Can this be a coincidence?

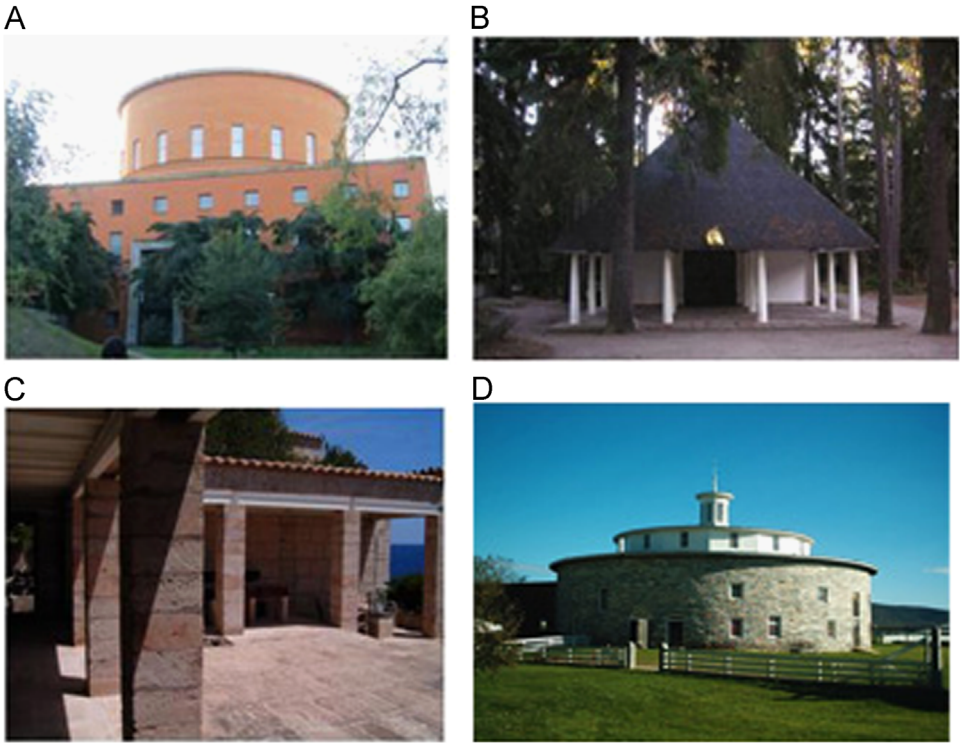

Figure 3 (A) Asplund, G. 1928. Stockholm Library; (B) Asplund, G. 1920. Skogskyrkogården Chapel; (C) Utzon, J. 1971. Lis House. Mallorca; (D) Shakers (anonymous), 1826. Round barn. Hancock Shaker village.

through superficial style attributes. However, this similarity cannot be a coincidence.

In the current ecologic criteria, timelessness is an essential factor. Importance for future generations on our planet is one of the basic criteria of the sustainability paradigm. "Future generations" have always been present in historical architecture in a singular and symbolic manner. Monumental and representative buildings, votive columns, and triumphal arches all attempted to pass on the glory of one generation to the next.

In our own age, from an ecological perspective, pertinent references to future generations have a specific role. We do not attempt to demonstrate our glory. The ecologists (deep ecology) conclude that our way of life leads to the exhaustion of natural resources. The existence of future generations is put in question because of the environmental problems we cause, which disrupt the continuing legacy of humanity. These considerations are timeless worries that link previous generations to future ones. Durability is a key component of green buildings. Consequently, we need durable and timeless architecture. Nowadays, green architecture gives rise to the technical issues of sustainable construction supported by tools of environmental impact assessment, such as LEED, GBTool, VERDE, and BREEAM. Long duration is a key factor in these current tools. Technical issues of sustainable construction arise from green architecture. Thus, we still need to develop conceptual and formal approaches.

3.6. Settlements in nature must be sincere and non-mimetic

Despite the many construction documents of Van der Laan, 3D drawings, perspectives, or original pictorial drawings are rare. However, the precision in all elements that define construction is immense and detailed, particularly regarding the dimensions of all spaces and elements. Van der Laan worked mainly with plans and elevations. However, some perspective sketches of elevations were produced. Wavy terrain, trees, and masses of surrounding trees are presented in the sketches with the same importance as the architectonic elements.

The drawings of Van der Laan are precise about how the Abbey of Sint Benedictusberg fits into the landscape. The older part of the abbey, which was built by Professor Dominicus Böhm (identified by the towers topped with cones), and the recent expansion of the Abbey by Van der Laan are easily recognizable in these drawings. The wavy terrain, trees, and masses of surrounding trees are presented in the sketches with the same importance as the architectonic elements. A pedestrian who approaches the abbey perceives it merely as it appears in the sketch. It gradually emerges and develops because of the location of the buildings on a small hill. No central perspectives or focal hierarchies exist, which is the exact opposite of Baroque. The building does not need to be represented; it is shown with complete simplicity. Access and entrance are apparently given secondary importance.[6] The entrances to the abbeys in Vaals (The Netherlands), Waasmunster (Belgium), and Tomelilla (Sweden) are simple and even austere when compared with the interiors, which are spatially rich.

The Dutch landscape (where the Sint Benedictusberg Abbey is located) in inland Limburg along the border with

[6] *A statue or monumental gate is an architectural element intended to commemorate a person or an event. Van der Laan chooses to keep the forms separate. In this way he creates a monument in Vaals by placing the cross in front of the church instead of placing in on top.* (Pouderoyen 2001a).

Figure 4 Van der Laan, D.H. Emplacement and access.

Germany is extraordinary. Van der Laan's main structures were all erected in stunning locations. "*Roosenberg Abbey constructs and embodies centres; centres within centres. The site itself is a centre carved out of a dense woods*" (Dawson, 2016b). The buildings are placed on a slab. The natural landscape is not emphasized from the exterior (Figure 4). Nevertheless, from any internal space built by Van der Laan, including the chapel, the exterior surroundings can be seen (Figure 1). In Sint Benedictusberg, "*the sole source of light in the chapel is via clerestory windows. The help you experience the central space as a building within a building. You know you inhabit a space inside the spaces that surround it*" (Dawson, 2016b). This layout is uncommon in Catholic churches, in which the architecture itself or the stained glass windows characteristically produce insulation from the exteriors. Again, Van der Laan did not think that churches need to have any specific architecture. For him, homes and man's measurement are what define architecture; a church is nothing more than a type of human room. His theories are not mystical. The Plastic Number is the empirical measurement of our perception.

Van der Laan describes the relations between architectonic space and natural space through three conceptual spaces: space for action, locomotion, and sight. The "cella, hof, and domein" (Dutch terms; translated into English, they mean cell, court, and domain) are the three elements of different scales in human space that relate man to his house and environment. We concretely experience cella, hof, and domain because of the massive elements that limit and form these spaces.

Beekhof (2013) pointed out that the insertion of Van der Laan's theory into a site offers another interesting interpretation. We can assimilate the "cella" into the simplest "hoes" or "huus," a precursor of hut, or "palloza," in which animals and men coexist in the same rectangular space with the central fire as the only separating element. These elements were created by aggregating large settlements, such as the primitive cities from Northern Europe. The articulation between the three elements describes the structure of the Netherlands today. Drainage canals continue to form a pattern that modulates virtually the entire country. This "aquatic" pattern has

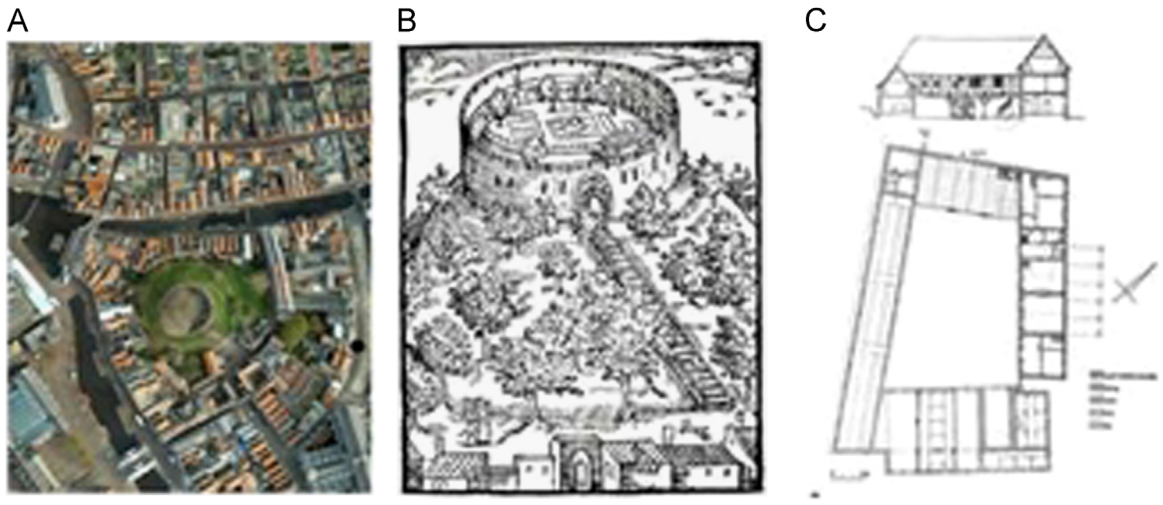

Figure 5 (A) Leiden: Birthplace of Van der Laan (black dot). (B) De Burcht. (C) Hof Mamelis.

developed over time into an urban structure that remains in cities, such as Amsterdam and Delft.

The Dutch landscape where the Sint Benedictusberg Abbey is located, namely, inland Limburg along the border with Germany, is extraordinary. However, the "regular plains of the Dutch landscape" hardly exist in Limburg. Cella, hof, and domain are clearly adapted in this particular landscape of the abbey, and these elements are not far from the traditional architecture of the surroundings. Van der Laan's religious congregation owns the Hof Mamelis (Van Agt, 1983), a village-like farm complex dating from the 14th century (Figure 5) that was recently restored. The farm complex is approximately 300 m from Sint Benedictusberg. In this farm, the articulation of spaces in courtyards, the architecture itself, the geometry, and the details, such as door structures, bolts, and locks, depict timelessness, much as the architecture of the abbey does.

Cella, hof, and domain are present in Sint Benedictusberg at different scales—from the small rooms of the monks to the total exterior landscape. Van der Laan's treatment of the cloister, interior, and exterior gardens makes renders more than just a single landscape; they become an articulation of landscapes. No exterior space exists. However, various types of exteriors, which are defined and delimited by walls and corridors by the order and type of vegetation, exist. According to Van der Laan, the universal function of architecture is the clear delimitation of space with walls. The space in nature extends endlessly vertically. However, in our experience of space, we notice and look for spatial limits horizontally. Architecture is borne out of the discrepancy between two spaces: the horizontalness of our experience and nature's verticalness. "*Van der Laan did not begin with a theory that would generate meaningful architecture: he began with experience which generated the theory*" (Dawson, 2016a).

Although all of Van der Laan's writings did not provide reference to other architects besides Vitruvius or to other buildings aside from Stonehenge, we must note that the local landscape must have exerted some influence on his theory. Van der Laan was raised in Leiden near De Burcht, a very important 11th century round fort set upon a hill in the middle of the city. The place is uncommon in Holland. (Figure 5). In the Dutch landscape, particularly in the cities, a few vertical elements relieve the overwhelming flat topography. The structure and position of De Burcht evokes both archaic and timeless forms. This building shows the autonomy and universality of architectonic expressions, "*how the particular function of a given building can change, without affecting the architectonic value of the structure. The burcht in Leiden, built as a fortress, is now a public garden*" (Padovan, 1994).

What could be the conclusion about the insertion of Van der Laan's buildings into nature? Timelessness, tradition, observation, and experience of nature are the roots of his theory and his work, which can be "read" directly in Van der Laan's buildings. This conceptual appreciation of nature contradicts many contemporary green architectures whose designers obsessively search for and repetitively mimic "organic" forms of living elements, such as ameba or elemental life forms, through digital tools for graphic representation. In striking contrast, Van der Laan approaches nature through human psychological experience rather than by copying organic forms. Van der Laan's approach to nature is based on our perceptual and psychological experience rather than on our wish to create an image of nature.

4. Conclusion

We studied Van der Laan because he developed his theory from a philosophic-humanist and architectural perspective in which nature has a fundamental presence. His theory and work may be analyzed from an "ecologist's" perspective, similar to the ideas of many other philosophers such as Thoreau, Tolstoy, or Gandhi who have contributed to and advocated for non-anthropocentric and pro-naturalist thought.

Van der Laan is of particular interest in this area because of his vision as an architect. He developed his theories and work (not just architectural) coherently. Van der Laan's work and theory are based on the concept of the harmonious relationship between the constructed natural world and the natural world per se. Van der Laan's idea that the constructed world completes nature may be the foundation of the theory that an "ecological" architecture needs to be applied. Van der Laan considers the intellectual capacity of human beings as a privilege, and we must study how our perception of nature is. That is, his approach to nature is

based on human perception (hence, on sensibility). Nevertheless, Van der Laan remains an insufficiently explored reference. Jonathan Middleton stated that,

> "*Whilst only his most ardent disciple would insist in the slavish imitation of Van der Laan's architecture, there are should lessons to be learned from the study of his theory and its manifestation in his building. There are universal and enduring lessons on the importance of limits; lessons in measured restraint; and lessons of observed moderation. In these more frugal times and with a built environment already littered with turgid icon, these are surely desirable lessons for this architectural generation to learn well and hold true to.*" (Middelton, 2010)

We can add to this dissertation that the technical and instrumental repertoire of the ecological architecture is not in contradiction with Van der Laan's constructions. On the contrary, the habitual "eco" issues are implicit and even surpassed. Van der Laan's work could be analyzed to determine the similarities with the current "eco" criteria: sense of timelessness; sensibility toward nature; importance of on-site landscape and settling; sequences that adapt the gradual passing from the interior to the exterior; use of basic and few materials for numerous functions; and considering the limits and "skin" as key subjects. Van der Laan is not merely a theoretical reference. His work also provides a practical and architectonic testimony.

We can deduct from Van der Laan's texts and work that we must arrive at nature through intellectual perception, not mimicry. Van der Laan's approach to nature is based on our perceptual and psychological experience rather than on our wish to create an image of nature. Architecture based on Van der Laan's principles and their examples satisfy all of the needs of a human being: physical, intellectual, and expressive. In the words of Dawson, (2016a) "*Van der Laan gives us the tools to create spaces for body and soul based on human perception and association*."

In comparison with "eco" architecture, if "green" only considers the physical, material world, Van der Laan's architecture is steeped in a vision of man with a psyche, a soul, a nature. We can give a positive answer to the question "could Van der Laan's theory be the piece that completes the gap between green architecture and human sensibility?"

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